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This paper should be the first of three.
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The Orbit of Comet Shoemaker-Levy 9 about Jupiter

D.K. Yeomans and P.W. Chodas, JPL/Caltech

After a tidal disruption by nearby Jupiter on July 7.8, 1992, cornet Shoemaker-Levy 9 broke into more than 20 large fragments and millions of smaller particles and dust. All of the comet's large fragments will be in Jupiter orbit until July 16-22, 1994 when they will impact Jupiter at some 60 km/s. Initially, a single heliocentric orbit was computed for this train of fragments using observations of the object's mid-train. However, as astrometric positions became available for the individual cometary fragments, separate heliocentric orbits were computed for the nine chunks for which a sufficient number of observations were available. These heliocentric orbits were integrated forward to predict the times and circumstances of the coming Jupiter impacts. Using a cometary disruption model developed by Sekanina, Chodas, and Yeomans (in preparation), consistent heliocentric and Jovicentric orbits were computed for all 21 of the major fragments. Beginning with a nominal orbit for the brightest fragment (Q). the time of tidal disruption in July 1992, as well as the initial separation distance and velocity of each fragment, was adjusted until the 1993-94 observations of the relative plane-of-sky separation distances and position angles were accurately represented. Once the initial conditions were established in this fashion, the motion of each fragment was numerically integrated forward to make impact predictions. There are nine fragments for which impact predictions have been computed from the disruption model and from independent orbit computations: for these fragments, there is excellent agreement between the two sets of predictions. For the brightest fragment (Q), the following elements represent the heliocentric and Jovicentric orbits (ecliptic, J2000) computed from 76 observations over the 1993 Mar. 30-1994 Jan. 21 interval:

	Heliocentric	Jovicentric
1994 Epoch (TDB)	Jul 15.0	Jul 15.0
1994 Periapses (TDB)	Mar 4.2137	Jul 20.7846
Eccentricity	0. S229256	0.9987338
Periapses dist.	5.3318770 AU	34776.7 km
Arg. of periapses	348.61136	43.47999
Long of asc. node	222.72657	290.87450
inclination	16.07451	94.23333

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